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Abstract

Many educators believe that teaching an integrated curriculum should help students develop cross-curricular connections. Often, however, students do not make connections between subject areas even when they are in classrooms with integrated units. This article presents a strategy called Brain Surfing that teachers can use to facilitate connections to subject areas during classroom discussions.

Jodi, a third-grade teacher in a large midwestern city, was frustrated. She had been integrating subject areas for years, but her students seemed to resist using their knowledge from different subjects in discussions about literature. She wondered why. Jodi knew that integrated instruction can lead to a more seamless curriculum and better learning (Beane, 1995) and which students learn concepts more effectively when instruction is integrated (Lipson, Valencia, Wixon, & Peters, 1993). However, Jodi was questioning the effectiveness of an integrated curriculum in helping her students make intertextual connections during discussions about literature. It just was not happening.

Because Jodi was a proponent of an integrated curriculum, she believed that her third-grade students could make cross-curricular connections. She believed with Shanahan (1997) that "integrated instruction works best when it makes children conscious of the

connections being made" (p. 18). So Jodi decided that she would look for better ways to encourage her students to make connections between the subjects, especially during literature discussions. To do this, Jodi asked me, a university professor, to help her conduct a study that would critically analyze her discussions about literature. I was eager to assist since I was in the process of working on strategies to help students make intertextual connections.

Jodi and I developed a research study using a formative experiment design. A formative experiment is neither a quantitative study nor a qualitative study. Instead, in a formative experiment an intervention is introduced and described. The intervention, then, is modified in response to data analysis (Jacobs, 1992; Reinking & Watkins, 1998). We thought that a formative experiment design would help us analyze the students' discussions about literature and yet would provide the flexibility to develop an instructional strategy.

We began the study with the question: To what extent can teacher questioning influence the cross-curricular intertextual references of students during discussions about literature? I introduced Jodi to a strategy I had developed, and she used the strategy to develop a questioning framework for discussions about literature. Jodi led the discussions while another teacher and I took field notes and audio taped and videotaped the sessions. After each session was concluded, the audiotape was transcribed for data analysis. Message units analyzed the data, and the message units were categorized using the procedures of inspection, categorization, and interpretation (Bogdan & Biklen, 1992).

After the data were coded, the three of us met to discuss our perceptions of the sessions and to reread the transcriptions. From those meetings, we discussed ways to change the intervention so that Jodi's students would make even more intertextual links (Lenski, in press). We conducted a total of seven sessions that began in October of 1997 and ended in March 1998.

The Evolution of Brain Surfing

We began our study on a warm Thursday morning in October. The students in Jodi's class had read *The Courage of Sarah Noble*

(Dalgiliesh, 1954) that week, and Jodi was going to use that story for the discussion session. Jodi called her third-graders to a colorful rug at the back on the room. Jodi sat in a rocking chair and proceeded to ask the students about the story.

As the discussion leader, Jodi developed questioning prompts that we hoped would help students make rich intertextual connections, especially to school subjects. The questioning prompts Jodi used were based on the Directed Reading-Connecting Activity (DR-CA), a questioning strategy designed to promote intertextual connections (Lenski, 1999). The DR-CA questioning strategy was designed to elicit intertextual connections from students. The DR-CA was based on Hartman's (1995) work that suggests that comprehension can be deepened through three types of intertextual links: intratextual links (links within a text), intertextual links (links across texts), and extratextual links (links beyond the text). Using DR-CA questioning, Jodi begins with questions about the text and then moves to questions across texts and questions beyond the text. The DR-CA can be considered a questioning framework that teachers adapt to individual texts. The DR-CA questioning prompts follow: How did this event in the story relate to another event? How did an event in the story remind you of another story? How is this story like your life? How did an event in the story make you think of something else you learned?

The discussion that ensued was rich in connections, primarily to the students' lives. After coding the transcription of the first discussion, we found that 47 percent of the utterances were coded as intertextual references. However, in only three instances did students refer to connections to class learning. Jodi made no connections at all to other school subjects.

After we read and coded the transcripts from the first session, we discussed Jodi's interpretation of the story and asked her how it related to the content subjects that she taught. There we had a revelation. Jodi had not thought of any specific connections between the text and the other subjects. She had asked students how they could connect the text to subjects, but that seemed to be insufficient. Jodi needed to have specific cross-curricular questioning prompts. Therefore, we decided to change the DR-CA strategy to make it specific to the subjects that Jodi taught.

We did this by developing a mind map to help Jodi, and ultimately her students, understand the possibilities of connections that could exist within their knowledge structures. Because Jodi would be actively looking for connections in different knowledge areas in her brain, Jodi dubbed the strategy Brain Surfing.

The Brain Surfing strategy that we developed is an intertextual cognitive strategy that helps readers integrate subject matter and expand intertextual thinking. Brain Surfing is a metaphor for actively searching for ways to connect knowledge that is stored in different areas in the brain. Like surfing the Internet, when students surf through knowledge domains, they locate knowledge that they can then combine in various ways. When actively applied, Brain Surfing is an individual cognitive process. However, Brain Surfing is more than a mind map for thinking. Brain Surfing is a discussion strategy that teachers can use to help their students experience different combinations of knowledge.

Brain Surfing as an Intertextual Cognitive Strategy

As students read, they constantly construct meanings from text. The meanings that readers create are intertextual; they are composed of the past and future texts in the reader's life (Bakhtin, 1981). Texts that are stored in a reader's memory can be constructed from print or other visual or auditory sources (IRA/NCTE, 1996). Intertextuality, therefore, is a cognitive strategy that enables students to construct meaning from the text that is currently being read and with other texts in the reader's experience.

The intertextual links that readers make are idiosyncratic and unique. A reader can construct meaning from a text in different ways, depending on the reader's purposes (Mackey, 1997). For example, a student who is reading *The Underground Railroad* (Bail, 1995) for pleasure would most likely read quickly gathering ideas and facts. The same student reading the same book for a research report would read more slowly and take note of the facts embedded in the story. With both types of reading, however, the student reading is changed. The knowledge gained from the current reading is stored in memory to be used in future constructions of meaning (Rosenblatt, 1978).

Knowledge is a multi-faceted prism. Each reflecting surface is a small piece of what is possible. Although brain research is in its infancy and applications to teaching are not fully tested, brain research suggests that information is stored in different areas of the brain that makes the transfer of knowledge difficult (Sprenger, 1999). Certain cognitive strategies, however, can increase the likelihood of transfer of knowledge (Jensen, 1995). Brain Surfing may be one of those strategies that can increase cognitive flexibility.

Brain Surfing as a Discussion Strategy

Discussions about literature help teachers and students deepen their understanding of the text and the ways in which the story connects to their lives. During discussions, participants offer their interpretations of the text. As they discuss the story, participants listen to alternative perspectives and decide whether to abandon, adapt, or confirm their initial thinking. The dialogue that takes place, then, helps students develop their individual constructions of meaning about the story (Almasi, 1995).

Discussions about literature are pervasive in the culture of postmodern classrooms. Interpreting texts, however, is an acquired social practice (Gee, 1988). Students are socialized to construct meaning in ways that have been accepted in the school culture. One tradition in literature discussions in schools is to construct meaning from a single text (Hartman, 1995) rather than from multiple texts. As a result, students tend to resist making cross-curricular connections. However, instructional activities can influence students' ability to create multi-dimensional links (Beach, Appleman, & Dorsey, 1990).

As students and teachers discuss texts and are encouraged to reach for a variety of intertextual links, they create more possibilities for new constructions of meanings (Bakhtin, 1981; Vygotsky, 1978). Making new intertextaul links is especially powerful when students and teachers have shared experiences, such as in school learning. For example, Jodi's third-grade class studied bats in one integrated unit. However, each student experienced the subject differently, based on his or her own background knowledge. Jodi, too, experienced the subject in a different way from her students. The shared, yet different, perspectives

on bats were the impetus for some interesting discussions that helped students make more cross-curricular connections and possibly to increase their overall learning.

Mapping the Territory

After Jodi and I developed Brain Surfing, we held a brainstorming session to make connections to the subjects Jodi taught in her classes. Jodi's students had recently read *Molly's Pilgrim* (Cohen, 1983), so we based the lesson on that story. Jodi and I reviewed her list of integrated units and thought about ways the units could connect with *Molly's Pilgrim*. Our final product took the shape of a graphic organizer with questions in different subject areas (See Figure 1).

Figure 1. Brain Surfing Connections to *Molly's Pilgrim*

Social Studies

1. What do we know about holidays that tell us about the setting of the story?
2. You've studied about communities. What size town do you think Molly lived in?
3. What is your clue in the story?

Science

1. With what you know about bats, would Molly have heard of bats before coming to America?
2. What information about bats would have been familiar or unfamiliar to Molly?

Math

1. When we look at Molly's day, what connections to math can you make?
2. When do you think social studies class was for Molly?
3. What time do you think Molly did her homework?
4. Was that A.M. or P.M.?

Language

1. Molly had trouble reading the word "Thanksgiving." What might she have done to figure out the word?
2. Could Jodi have done anything before giving this assignment to help Molly and protect her from the mistake she made?

Music, Art, Physical Education

You know about the country of Russia. How would you design a dress for Molly's pilgrim?

Other Stories

1. We just read the book, *The Statute of Liberty*. With all you learned in that book, do you think the Statute of Liberty would have been an important part of Molly's life?

2. Molly's mother said they could not return to Russia. Knowing what we read in *Since 1920*, why may it be hard to go back to Russia?

Jodi began this discussion session telling her students about Brain Surfing. She told her students that she had actively searched her brain for connections to the subjects that they had learned in class. She then encouraged her third-graders to make their own connections to subjects they had learned in school. To facilitate the discussion, Jodi created a bulletin board with subject areas headings. With each connection students made, she had them attach a space figure to that area.

The second discussion session using Brain Surfing was rich in intertextual links to other subject areas, increasing to 25 percent of the connections Jodi made and 8 percent of the students' links. Jodi was happy with the discussion and intended to model Brain Surfing during the third session.

Students' Self-Questioning

Jodi modeled Brain Surfing for the third session. After this discussion session, we met again and talked about whether students could create their own cross-curricular questions. We knew that even young children can be taught to ask questions (van der Meij, 1993), and we believed that Jodi's third-graders could Brain Surf on their own. Therefore, we asked the students to generate questions for the story *Justin and the best biscuits in the world* (Mildren, 1986). Figure 2 has a sampling of the questions the students generated.

Using Brain Surfing in Discussions

From these sessions using Brain Surfing we found that students were making more cross-curricular connections. As we read through the transcriptions of the discussions, we found that Jodi used Brain Surfing as an organizational framework but that she also used additional questioning strategies. The additional questioning strategies that emerged from the data were not preplanned. Instead, Jodi intuitively used different strategies for each of the seven sessions based on her knowledge of the text, her beliefs about the students' knowledge, and her perceptions about the needs of the students. Six primary questioning strategies used in conjunction with Brain Surfing were identified: casting a wide net, testing the waters, developing a concept, clarifying complex issues, living the story, and stretching ideas.

Casting a wide net. One of the questioning strategies that Jodi found useful was to develop a number of questions that she felt captured her interpretation of the story. Jodi developed intertextual questions that "cast a wide net." As Jodi asked a wide variety of questions, she was able to identify additional intertextual references that the students made, areas of interest to the students, and areas for future discussions. Jodi wrote that the variety of questions helped her "expand my interpretations of the children's responses" (teacher's memo October 28).

As Jodi created an overview of the story by her questions, she was able to determine the students' construction of meaning. In session 2, for example, Jodi asked a variety of questions. One question was, "What time of day do you think it was when her mother made the pilgrim for Molly?" Several of the students and Jodi agreed that the time was 8:30 P.M. Periodically throughout the session, a few students returned to this question and tried to convince Jodi that another perspective fit the facts of the story. The conversation that ensued was filled with references to the text, to the students' lives, and to multi-dimensional references. Furthermore, the students persisted in trying to develop their own meaning to fit the story. One student said, "It couldn't be 8:30 because her mom said go out and play and it would be dark at 8:30." After a lengthy discussion, Jodi stated, "I had pictured it later at night in my head when I read it, but you are right."

In this case, Jodi had constructed meaning from the text using her background knowledge. During the discussion, Jodi told the students, "When you read a book each of you picture the time differently, don't you, because of your background." However, the knowledge that Jodi constructed was at odds with some of the students' construction of meaning. Because Jodi cast a wide net of questions, she was able to identify an interpretation she had that differed from her students' interpretation of the text. After probing about the issue, Jodi realized that the students were correct, and she modified her own interpretation.

Figure 2. Questions Generated by Third-grade Students: Justin and the Best Biscuits in the World

Social Studies

1. Thinking about what we've learned in social studies, how was Justin's community different from his grandfather's?

2. From looking at the pictures of Grandpa's house in our story, what type of home do you think he lived in?

3. With what you know about our past, why do you think Justin's grandpa lived in an older house?

4. The story tells us that Justin's grandpa was a slave when he was a boy. What have we learned that would have allowed us to guess that if the story hadn't told us?

5. You know a lot about communities. Since Justin was from the city, do you think he should have known how to do the chores his grandfather gave him?

6. We have learned a lot about ancestors. How would Tia Rose's ancestors be different from Justin's?

7. What part of the word does Justin's grandpa live in? What hemisphere?

8. Justin's ancestors traveled from Tennessee to Missouri. What states did they travel through? What was the countryside like? If you don't know, where could you find out?

Science

1. From what we see in our story, what kind of surface water was on Grandpa's farm?

2. Think about our hedgehog, Reggie. Would the animals Justin took care of be more or less work that Reggie is?

Math

1. What math skills do you think Grandpa and Justin used when they made biscuits?

2. You have learned a lot about time. Tell some things that happened in the story and tell me if it is A.M. or P.M.

3. Estimate whether more people thought Justin could do things right or that he couldn't.

Language

1. With what you know about building fires, do you think Justin's fuel was unusual? How can you figure out what the word *unusual* means?

2. Was the house Justin's grandpa lived in big or small? Is your answer a fact or an opinion?

3. Think about when you have been alone outside. Why would Justin think the winds were whispering in the trees?

Music, Art, Internal to story

1. You read that Justin's sisters said he couldn't do very much. How does it make you feel when you read that?

2. Justin's grandpa lives out in the open. If he didn't know how to do any work, what would happen to him?

3. Pretend you don't know where this story takes place. You know there are diamondback rattlers here. What book would you use to find out where the setting might be?

4. Why did Grandpa say, "Want to see how a man makes a bed?"

5. How would Justin describe "women's work" and "men's work"?

Other Stories

Before winter break we read a story called *A Gift for Tia Rosa.* How are these two stories similar?

Testing the waters. A second questioning strategy that we identified was termed "testing the waters." Occasionally, Jodi tried to determine whether the students understood a topic. Jodi asked several intertextual questions just to see what the students would say. If students showed little interest in the subject or if they had no questions, she moved on. If students had opinions to share, she allowed time to probe more deeply. If the students' responses indicated that they needed more information, she structured the questions to help students understand what they did not know.

In session 4, for example, Jodi did not know if the students were familiar with the kind of knitting that Tia Rosa was doing in the story *A Gift for Tia Rosa* (Taha, 1986). Therefore, she asked a question that related to another subject (math) that would let her know whether students understood the term "knitting." Jodi asked the following question, "What would have happened if Carmela forgot part of her pattern when she was knitting?" Then Jodi asked the students whether they were familiar with knitting needles. They did not know what a knitting needle was, so Jodi held a lively discussion probing the students' knowledge related to knitting. She asked questions about their personal experiences, things they had read or seen on TV, and further questions about the story that could shed light on students' understanding. By "testing the waters," Jodi was able to determine whether to use additional intertextual references to add to students' knowledge.

Developing a concept. During at least one session, Jodi identified a concept essential to the meaning of the story. At times, students do not understand a central concept of a story that hinders their construction of meaning. To develop a concept, Jodi used intertextual references to build on students' knowledge, and then she incorporated new information, and scaffold students' learning so that they had a clearer understanding of the central concept of the story.

In session 3, Jodi wanted students to understand that being blind did not mean total dependence on others. From previous class discussions, Jodi did not think that the students had a very good understanding of the concept. Therefore, she asked the following question, "Can blind people fix their own dinners?" Students answered that they could not. Jodi referred the students to the story, *Through Grandpa's Eyes* (MacLachlen, 1980), and asked what students read in the story that would answer the question. However, the students used a different type of connection to form their conclusion. One student said, "It reminded me of that home mission where they deliver all the food to people who can't cook who are old." Jodi then used the student's reference to ask a second question. "We're making cards for Home Sweet Home Mission and we deliver them to senior citizens. Is there a difference between being a senior citizen and being blind?" From this question, Jodi found out that these third graders did not understand the concepts of "blind" and "senior citizen." For example, Jodi stated, "If I tell you that I'm going to be a senior citizen in a few years, will I be different from being blind?" The students said she would not. Another example is a student who asked, "Why don't they (blind people) just get glasses?" Jodi continued to develop the concepts throughout the session referring to the text, to students' experiences, and to other texts.

Clarifying complex issues. At times complex issues surfaced during discussions. Interestingly, some of the issues Jodi thought were simple turned out to be difficult for students. As students connect knowledge in new ways, the cognitive restructuring that takes place can lead to misconceptions. For example, in session 2, Jodi asked, "What is it we know about holidays that will tell us a little bit about the setting of the story." Students discussed the idea that the celebration of Thanksgiving (as it was described in the story) is an American holiday. However, the students has also learned in social studies that pilgrims were one of the immigrant groups that came to North America and that the pilgrims celebrated the first Thanksgiving. This led one student to ask, "Doesn't England celebrate something like that because someone in that country found the United States, so don't they celebrate something similar?" This question led to a number of additional questions such as, "Does Hawaii celebrate Thanksgiving?" and "Do the people who move from American still celebrate Thanksgiving?"

The discussion then turned to the importance of the Statue of Liberty to immigrant groups. The students, however, had difficulty understanding why immigrants would see the Statue of Liberty as they came to the United States. One student asked, "If they [immigrants] came from Russia to Florida, would they pass the Statue of Liberty?" The students in this class, who were much more familiar with airplane travel than travel by ship, used their background to make sense of the story. Jodi, however, was able to use the discussion to clarify the issues that were complex for students.

Living the story. Students can use a variety of intertextual links to put themselves in the story. One questioning strategy that Jodi used was termed "living the story." For this strategy, Jodi had students call on past experiences and their knowledge of the world to enter into the story they were reading. For example, in session 1, Jodi asked, "If you were in the woods with Sarah and her father, what type of things would you be frightened of?" Students answered with a variety of ideas. A short interaction between Jodi and one student follows:

Student: Sounds, because I'd think someone was following us or watching us.

Teacher: Has that happened to you before?

Student: When were camping out at Yogi Bear Park, we kept hearing sounds and I had to keep telling myself it was OK.

Stretching ideas. A final questioning strategy Jodi used was "stretching ideas." Part of reading is stretching ideas to think abstractly and differently. Understanding and imagining are part of the experience of reading literature. As students read, they not only construct meaning from understanding the story, but in thinking beyond the plot. Jodi in this study asked questions to encourage students to stretch ideas as they constructed meaning from text. Students used their personal experience and knowledge outside the text to stretch their ideas as in the following example:

Teacher: What color would you color courage?

Student: Red, like the flag because it's like the courage of the people of the army and the blood that was spilled.

Student: Brown, that's the color of my dog. It's not a real dog, a stuffed animal, and I was embarrassed to ask for it.

Versatile Decision-Making

Of the six questioning strategies that Jodi used in this study, some were planned by Jodi before the discussion, but most were used in response to the discussion. As Jodi led the discussion, she was consciously trying to encourage students to use intertextual references to construct meaning. She wrote discussion questions in advance and believed that her preparation allowed her to respond to student needs during the discussion. Jodi wrote, "Having them (questions) written down ahead of time allowed me to relax with the children and also helped me know that I was ready with the next direction if we drifted too far off shore." (Teacher's memo October 28)

As Jodi responded to students' needs, she made decisions about whether to pursue her original path or to journey down paths set by students. As Jodi said in one session, "I see a lot of answers out there." One of the decisions Jodi made was whether to follow up on off-subject responses. Off-subject responses can, at times, indicate students' construction of meaning. For example, Jodi queried in a memo, "Does it matter that they go off in other directions? They enjoy it and doesn't it just lead to connections that I, as a teacher, wouldn't have thought of?" (Teacher's memo October 28) Jodi continued, "Some of the things the children brought up, I tended to pull them away from. Later, as I thought about how wild the connections were, I realized that they were really necessary for the children to understand." (Teacher's memo October 28) Jodi's versatile decision-making allowed her to continue to encourage intertextual links yet blend her purposes with student responses.

Conclusions

Students can make connections from literature to their school subjects. One way to facilitate cross-curricular connections is through the use of Brain Surfing. Brain Surfing is an organizational tool that

integrates topical knowledge with literature-based knowledge. In this study, the third-grade students made more cross-curricular connections when Jodi had prepared the discussion using the Brain Surfing mind map. The third-grade students were also able to use the Brain Surfing organizer to ask themselves questions about the story that connected to school subjects. The Brain Surfing framework was used in a variety of ways to elicit more connections. These questioning strategies, along with the Brain Surfing framework, became part of Jodi's teaching routine. As the year progressed, Jodi began noticing that her students consistently made cross-curricular connections in class discussions. Through using the strategy Brain Surfing, Jodi found that her integrated teaching was becoming integrated in her students' minds.

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